Review Article

Application of Google Earth Software in Understanding Environment Impact Assessment of Mining Project

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A B S T R A C T

K e y w o r d s

Google earth software, Mining, environment, Land use, Geological mapping, Environment impact assessment, Land acquisitions, Satellite imagery, Geographic information system, Environment management

This technical paper shares the role of different applications of open-source software Google Earth for understanding and presenting Environment Impact Assessment (EIA) of mining projects. In a study in-depth study of the satellite imageries was carried out on the Google Earth software in the different mining areas around Udaipur & Chittorgarh district in the State of Rajasthan in the north-western part of India. The different satellite imageries were taken from the different parts of Mining areas in the region and comparisons were made from Historical Satellite Imageries to understand the actual assessment of environmental impact of the respective mining project in the study area. The impact assessment could be understood from the social-economic development around the area and the changes in the pattern of land use around the mining area. The Google earth software is the world's most detailed representative globe from which we can explore the natural, man-made structures worldwide and also their corresponding satellite imagery and three dimensional images. It can provide a 360° perspective of any selected mining area or of street view of any city by zooming into the software by just sitting in the house.

Introduction

Google Earth's imagery is displayed on a digital globe, which displays the planet's surface using a single composited image from a far distance. After enough zooming-in, the imagery transitions into different imagery of the same area with finer details, which varies in date and time from one area to the next. The imagery is retrieved from satellites or aircraft. Before the launch of NASA and the USGS's Landsat 8 satellite, Google relied partially on imagery from Landsat 7, which suffered from a hardware malfunction that left diagonal gaps in images. In 2013, Google used data mining to counter the issue, providing what was described as a successor to the Blue Marble image of Earth, with a single large image of the entire planet. This was achieved by combining multiple sets of imagery taken from Landsat 7 to eliminate clouds and diagonal gaps, creating a single "mosaic" image. Google now uses Landsat 8 to provide imagery in a higher quality and with greater frequency. Imagery is hosted on Google's servers, which are contacted by the application when opened, requiring an internet connection.

Imagery resolution ranges from 15 meters to 15 centimeters. For much of the Earth coverage, the Google Earth uses digital elevation model data collected by NASA's Shuttle Radar Topography Mission. This creates the impression of three-dimensional

terrain, even where the imagery is only two-dimensional.

Google asserts that every image created from the Google Earth using satellite data provided by Google Earth is a copyrighted map. Any derivative from Google Earth is made from data on which Google claims copyright under United States Copyright Law. Google grants licenses in this data allowing, among other things, non-commercial personal use of the images (e.g., on a personal website or blog) as long as copyrights and attributions are preserved. By contrast, images created with NASA's globe software World Wind use The Blue Marble, Landsat, or USGS imagery, each of which is in the public domain.

In version 5.0, Google introduced Historical Imagery, allowing users to view earlier imageries. Clicking the clock icon in the toolbar opens a time slider, which marks the time of available imagery from the past. This feature allows the end user for getting observations of changes in an area over the interval of particular time. Utilizing the time lapse feature allows for the ability to view a zoom able video as far back as 32 years.

Environment impact assessment

Environmental Impact Assessment (EIA) is a process of evaluating the likely environmental impacts of a proposed project or development, taking into account inter-related socio-economic, cultural and human-health impacts, which can be beneficial and adverse both.

EIA is systematic process that examines the environmental consequences of the developmental action in advance. The emphasis of EIA is on the prevention through continuous monitoring of air, water, vegetation, land & people of the surrounding area of proposed project.
The EIA process involves a set of steps given as follows:

1. Screening of impacts.
2. Scoping & consideration of alternatives.
3. Baseline data collection.
4. Impact prediction.
5. Environmental management plan (EMP).
6. Decision making.
7. Monitoring of air, water, noise, biodiversity, social etc. seasonally and annually.
8. Assessment of alternates.
9. Public hearing.
10. Secondary data collection for air, water, noise, vehicle, social etc.

Components of development and associated Environmental Impacts in Mining projects are well known and some of the major important development components associated with these are tabled below:

S. No.	COMPONENTS	S. No.	COMPONENTS
1.	Land Acquisition	8.	Site Development - Construction camp, creation of infrastructure including roads etc.
2.	Top Soil removal and storage	9.	Drilling and blasting
3.	Overburden removal and storage	10.	Toxic waste treatment
4.	Mineral extraction	11.	Mine water pumping
5.	Disposal	12.	Mineral transport
6.	Heavy earth moving machinery (HEMM) use and its maintenance	13.	Site restoration/reclamation -backfilling, treatment, spreading of top soil, re-vegetation
7.	Mineral Processing		

Creation of EIA data base

The baseline data relevant to the study for the preparation of EIA report can be derived from spatial data using remote sensing and GIS technologies and non-spatial data from field survey and other sources if it is secondary data. The data products derived from various sources are stored in database management systems. The EIA data base either in the form of digital mode or paper based data consists not only baseline data but all types of data products needed for the end product that is, an EIA report. To store such huge quantity of data, if it is digital mode may be stored in GIS data bases management system like ArcGIS, but in this study we have used Google Earth software which has already has numerous feature which allow the user to learn about specific places. These are called "layers", and include different forms of media, including photo and video. Some layers include tours, which guide the user between specific places in a set order. Layers are created using the Keyhole Mark-up Language, or KML, which users can also use to create customized layers. Locations can be marked with place marks and organized in folders.

Applications of google earth engine

Google Earth Engine combines a multi-petabyte catalog of satellite imagery and geospatial datasets with planetary-scale analysis capabilities and makes it available for scientists, researchers, and developers to detect changes, map trends, and quantify differences on the Earth's surface.

Use of google earth in mining

After launching the Google Earth following mining specific applications can be effectively carried out:

1. Point Marking
2. Lease Demarcation
3. Show Elevation Profile
4. Area Measurement
5. Path or Line Measurement

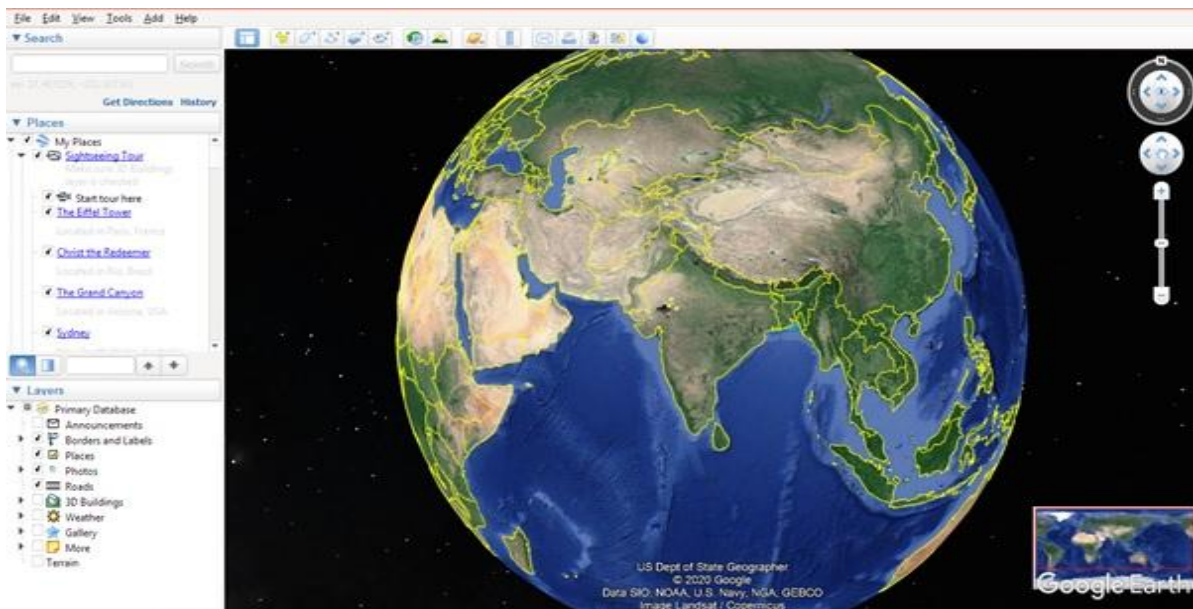**Image.1** Screen Shot Image of Google Earth Pro Version

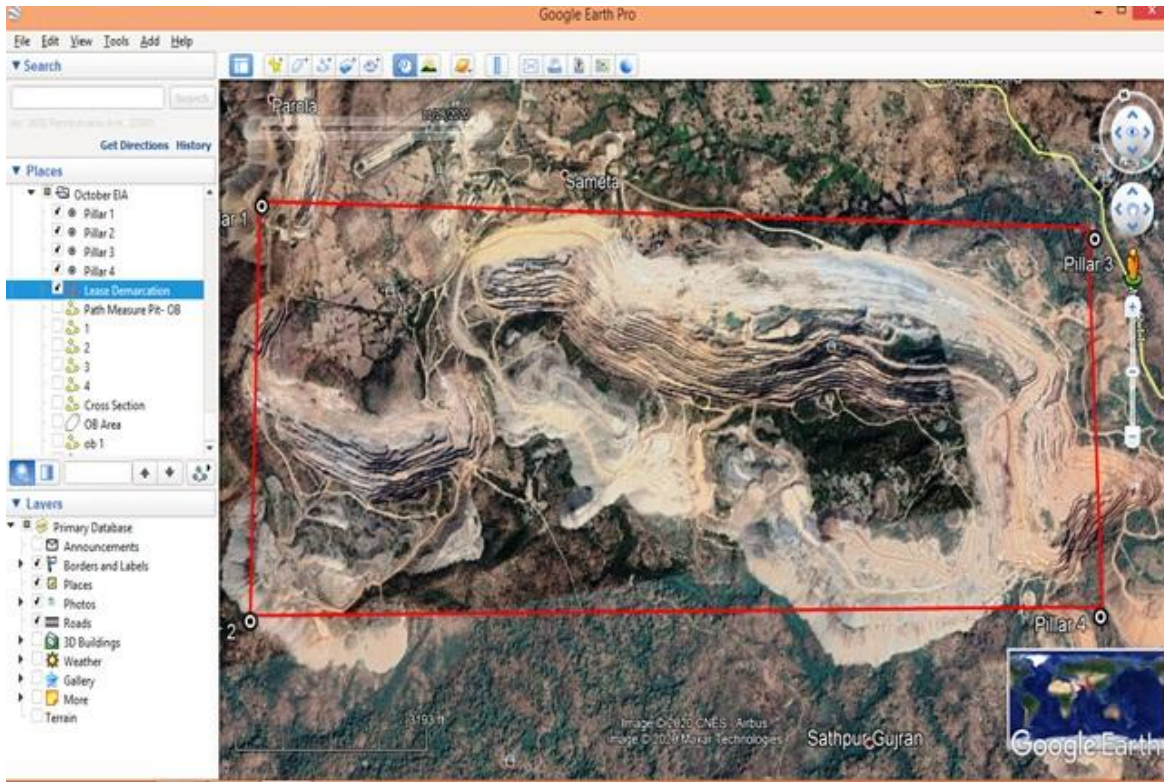**Image.2** Screen shot image of mining lease area showing lease demarcation

Image.3 Screen shot of Google earth image view of tool bar showing Historical Imagery
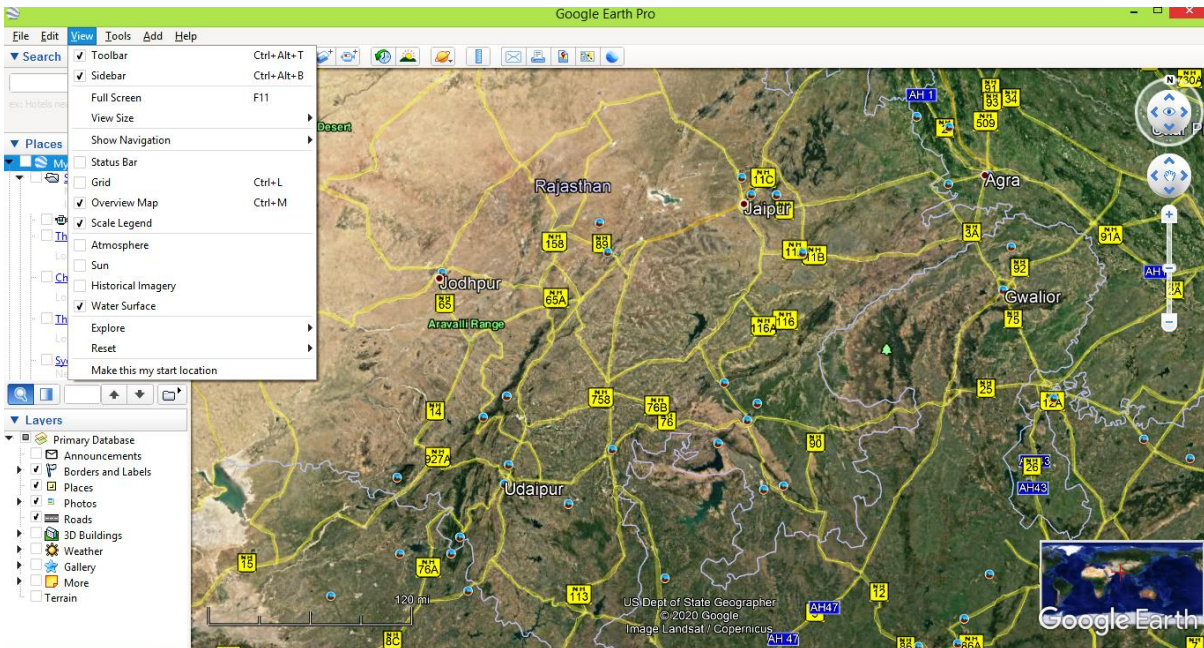
Image.4 Screen shot of Google earth image view of tool bar showing Add folders & place mark
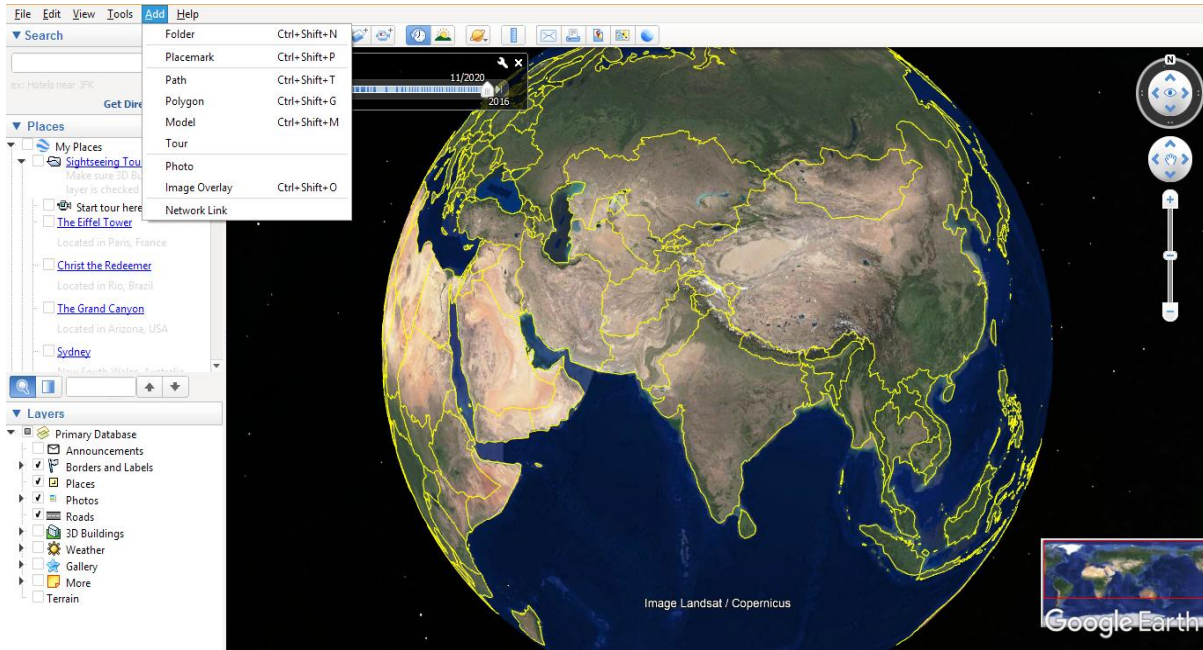

Image.5 Satellite Imagery of Mining Area in 2006 of Mining Area, Udaipur
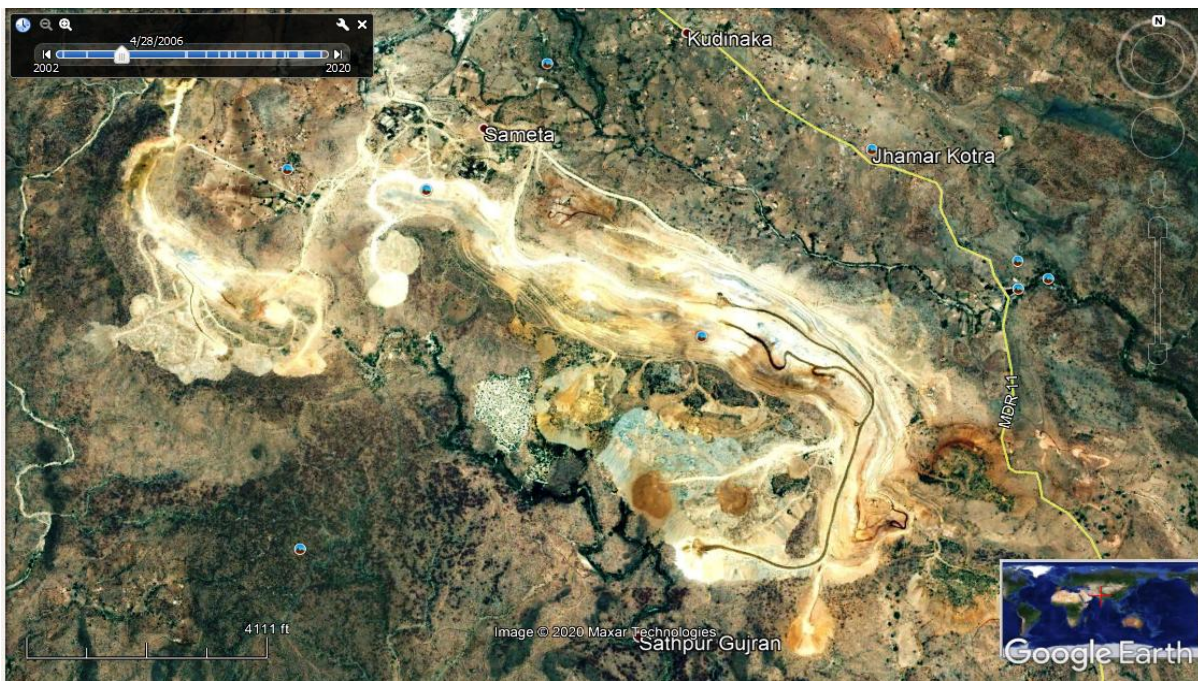
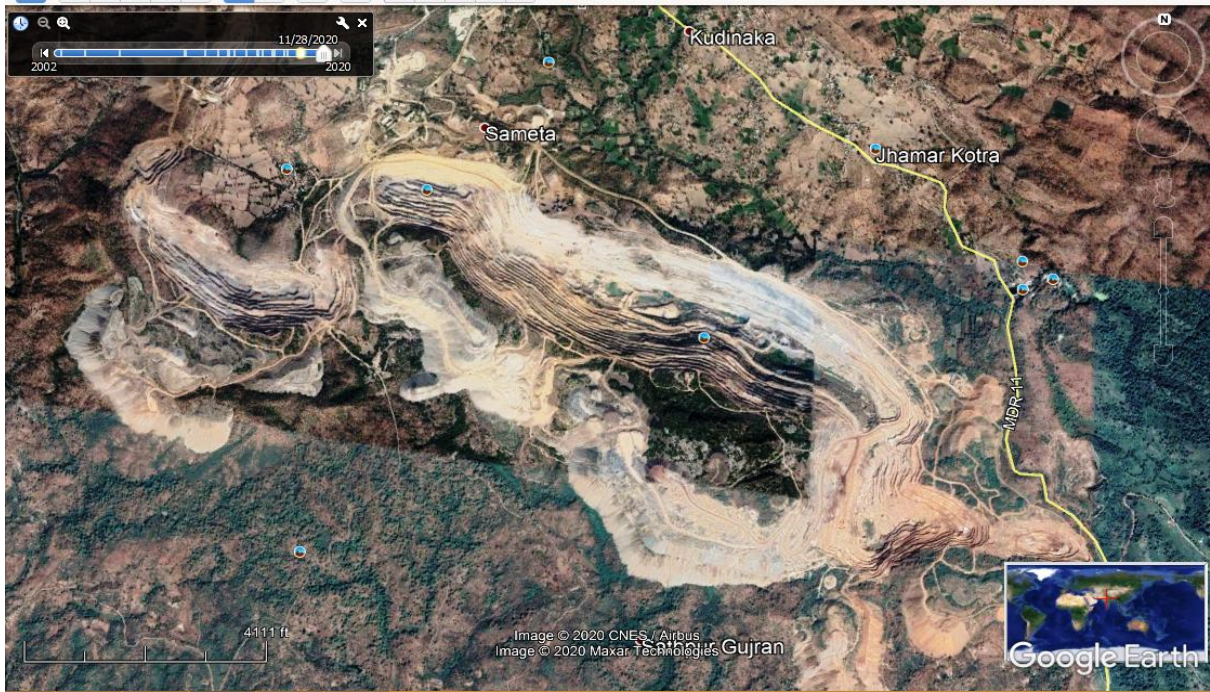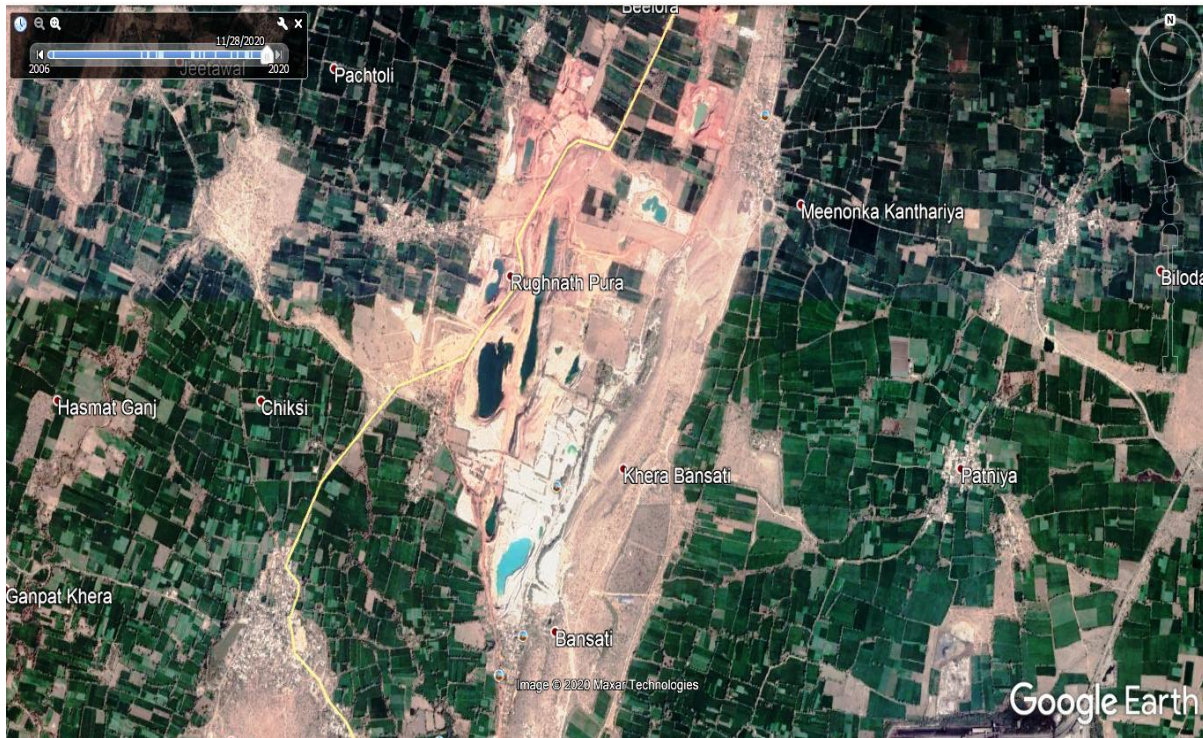**Image.6** Satellite Imagery of Mining Area in 2020 of Mining Area, Udaipur

Image.7 Satellite Imagery of Mining Area in 2020 of Mining Area, Chittorgarh

Image.8 Satellite Imagery of Mining Area in 2020 of Mining Area, Chittorgarh

Historical satellite imageries and their comparison

In the Google Earth software when we launch it, then in the left side bar we have Side bar and tool bar from which we can customize our working.

Now with the above toolbars and adding place marks with polygons and points we can demarcate, place mark and calculate the area of mining, vegetation and changes in land use pattern happened in the earlier years.

In the below Satellite Imageries we have observed and studied the Mining area in the Udaipur region in year 2006 and present year that is 2020. It can be clearly assessed from these, the development in the mining, changes in the land use and plantation activities carried out over the years by the mining industry. This can be very useful in presenting the EIA of the same.

In the below Satellite Imageries we have observed and studied another Mining area in the Chittorgarh region in year 2006 and present year that is 2020. Development in the mining, changes in the land use and plantation activities carried out over the years by the mining industry is clearly visible.

In conclusions, by studying the application of Google Earth software in two important areas of Udaipur region of Rajasthan, India, for understanding Environment Impact Assessment (EIA) of Mining Project, we can conclude: 1. We can utilise the open-source Google earth software for the comparison of the satellite imageries from old to latest and subsequent actual impact (positive and negative both) can be understood by using different software and toolbox. 2. In the Google Earth software by importing survey data of mining area, we can demarcate

mining lease boundary and the contour plan by using Global Mapper, Auto CAD software and also the assessment of advancement of Mining operations and changes in the Land Use pattern.

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